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## [54] SAMPLE EXTRACTOR 5 Claims, 4 Drawing Figs.

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 222/199, 222/504, 198/220BA

[51] Int. Cl..... B67d 3/00

[50] Field of Search..... 222/76,  
 330, 318, 482, 483, 484, 485, 199, 76, 70, 504;  
 441/248; 198/220; 221/76, 199, 504

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**ABSTRACT:** A small quantity or sample of particulate material which is representative of a much larger batch of material, such batch in turn being representative of a large supply mass of the material, is extracted by feeding the batch to a dispensing head having two nozzles. The nozzles are alternately uncovered by a cyclically operated valve and a control is provided to variably proportion the residence times of the valve in its two positions so that the sample constitutes more or less of the batch. A second control is provided to increase the feed time for the batch as the residence time of the valve in that position discharging the sample is decreased in proportion to the residence time in its other position.

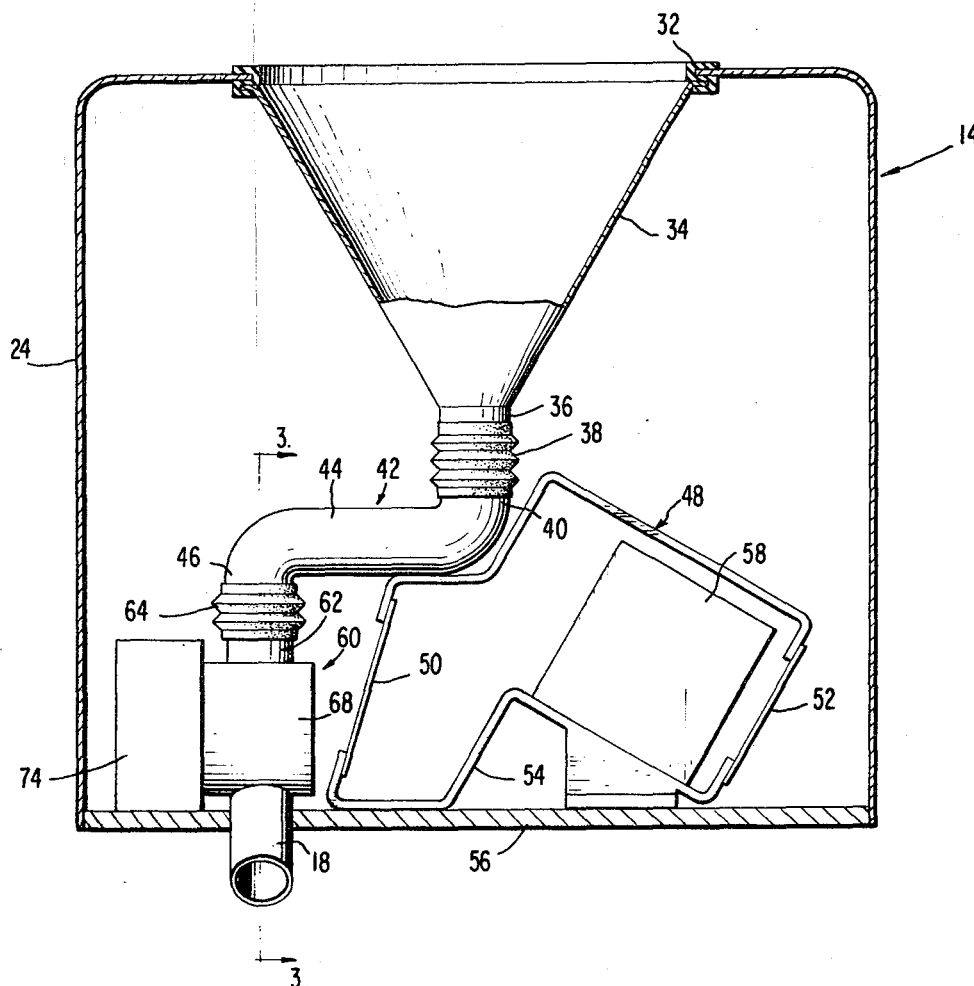


FIG. 1

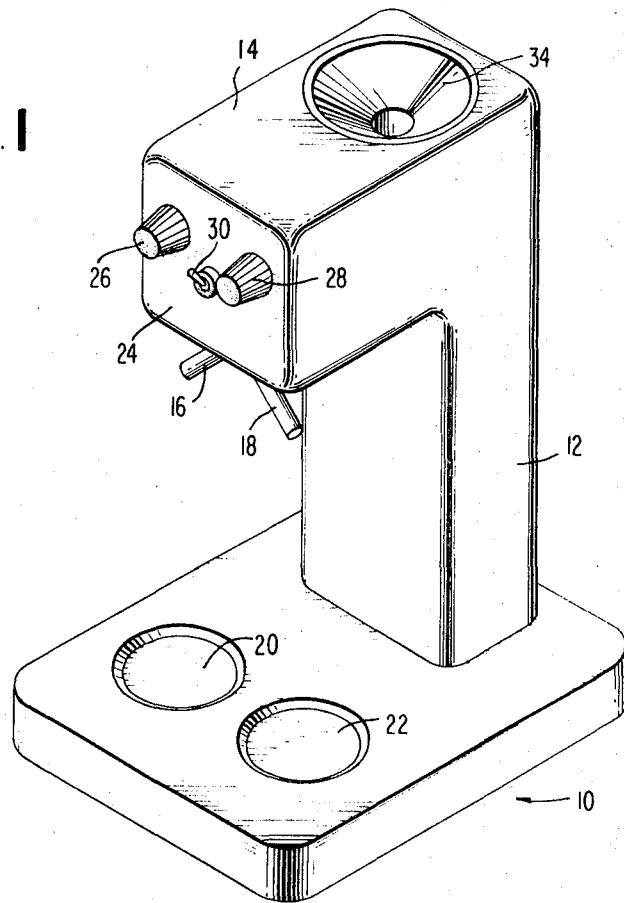
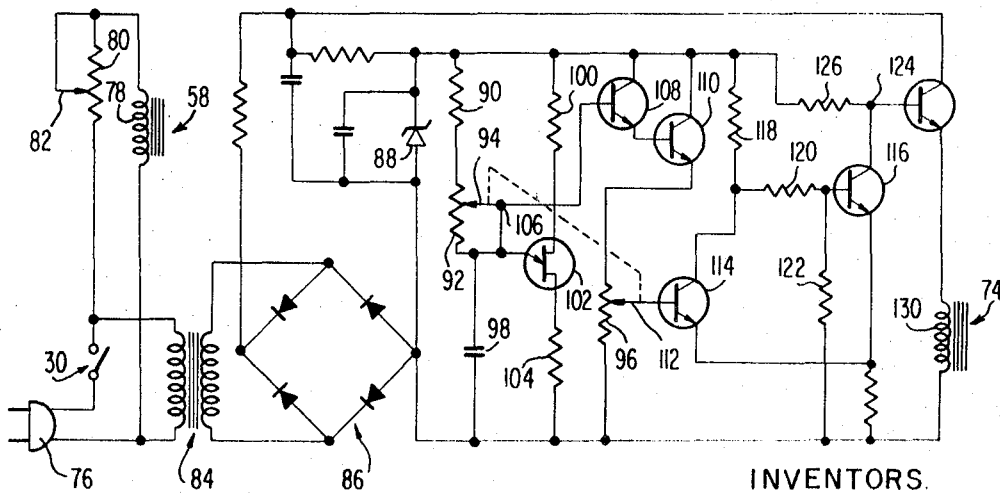


FIG. 4



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FIG. 2

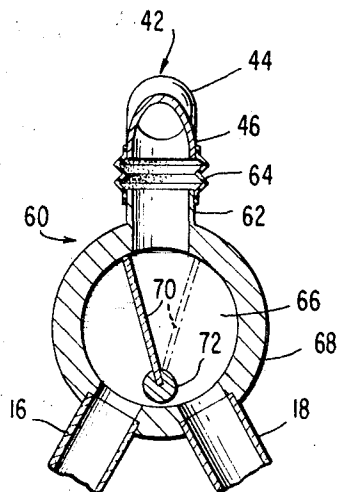
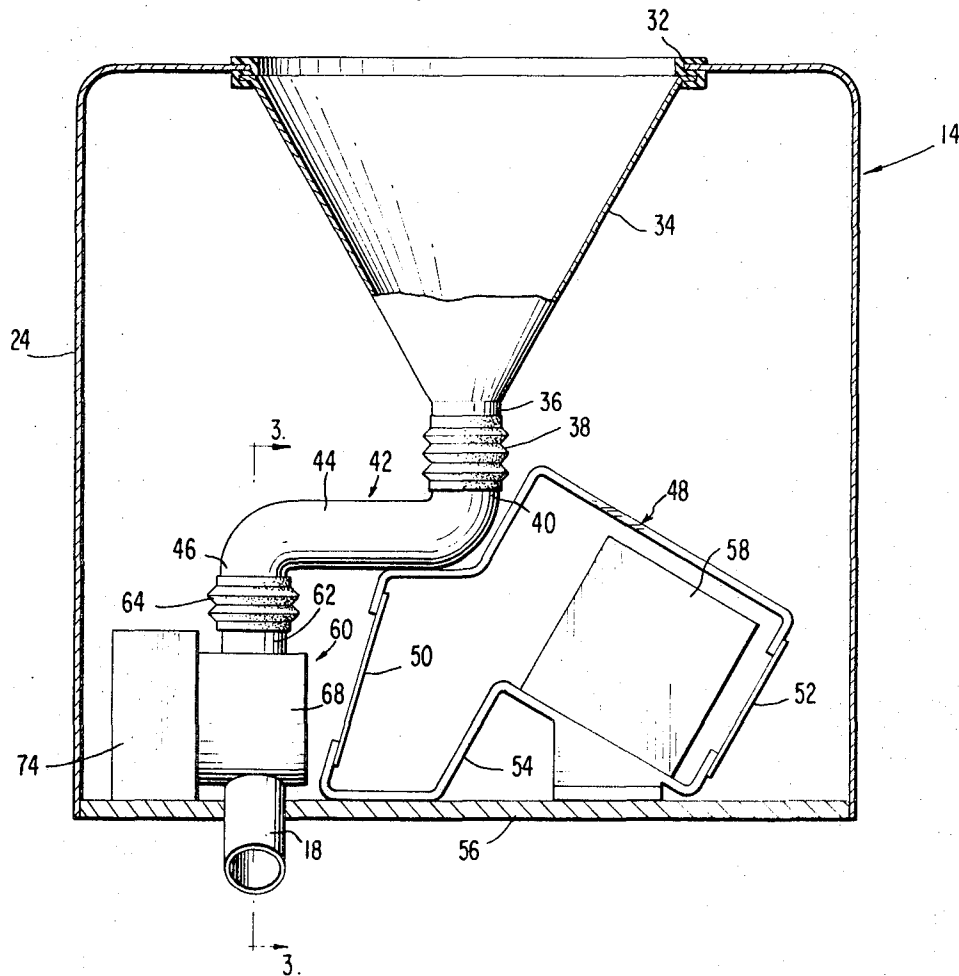


FIG. 3

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## SAMPLE EXTRACTOR

## BACKGROUND OF THE INVENTION

Many powdered products require analysis at one or more stages of their processing, the accuracy of the analysis being dependent upon the extent to which the sample extracted for analysis represents the supply or mass from which it was obtained. The techniques for analysis have advanced to the stage that only a small sample of the product is required, but such small samples may not be extracted directly because to do so would be to introduce the probability that the sample so extracted would not be truly representative of the material under consideration. Instead, a fairly sizeable batch of material is first extracted to assure representation of the parent mass and from this the small sample is obtained.

Numerous methods have been employed to extract the final sample from the batch of representative material, including hand cutting and various mechanical operations designed to produce a small, representative sample for analysis. These conventional methods are time consuming, cumbersome and in general are difficult to execute.

## BRIEF SUMMARY OF THE INVENTION

The present invention is directed to apparatus for extracting a small sample of particulate material from a larger batch obtained from the mass of particulate material to be analyzed, the batch and sample both being representative of the parent mass. The apparatus consists of a reservoir or receiver for the batch, a dispensing head and a feeding or conveying mechanism for delivering the material to the dispensing head. The dispensing head is provided with a pair of nozzles, one of which dispenses the sample, and valve means is associated with the dispensing head to alternately dispense material from the two nozzles. The valve means is so actuated as to cause it to dwell in its two positions in aliquot portions of the period of each cycle and the ratio of these aliquots may be varied to extract the desired sample size or quantity.

The feed time of delivery to the dispensing head is also variable so that as the aliquot portion of the sample is reduced, the feed time may be correspondingly increased whereby the shortened residence time of the valve means in the sample-dispensing position will not represent such a short absolute time as will deleteriously affect either the quantity or the representative value of the sample.

The apparatus is also characterized by the fact that it is compact and is readily cleaned. The material feed mechanism consists of a vibratory conveyor and its amplitude is variable to control the feed rate. The valve means consists of a rotary solenoid driven by a circuit which includes a relaxation oscillator of variable frequency whereby the residence times of the valve means are variable aliquots of each cycle.

## BRIEF DESCRIPTION OF THE DRAWING FIGURES

FIG. 1 is a perspective view showing the apparatus according to this invention;

FIG. 2 is an enlarged vertical section taken through a portion of the apparatus;

FIG. 3 is a vertical section taken generally along the plane of section line 3-3 in FIG. 2, showing details of the dispensing head; and

FIG. 4 is a circuit diagram illustrating a drive and controls for the apparatus.

## DETAILED DESCRIPTION OF THE INVENTION

With reference first to FIG. 1, the apparatus may take the form of a unitary device including a base or stand 10 from which a hollow housing 12 vertically projects, the housing including an upper horizontal limb portion 14 which overhangs the base and from which a pair of discharge nozzles 16 and 18 depend. A pair of depressions 20 and 22 in the base 10 are

adapted to receive and position suitable containers such that they will receive the material dispensed from the respective nozzles 16 and 18. The front panel 24 of the portion 14 mounts a pair of control knobs 26 and 28 as well as an off-on switch 30, the purpose of which will presently appear.

As may be seen in FIG. 2, the top wall of the limb portion 14 is provided with an opening receiving a suitable gasket or bezel 32 which locates the upper portion or rim of a funnel or hopper 34 with such opening, the funnel or receiver being housed wholly within the portion 14. The discharge spout 36 of the funnel 24 is coupled by means of a flexible sleeve 38 to the upstanding leg 40 of the feed chamber or chute device 42, such chamber having a horizontally disposed main body portion 44 and a depending leg 46 at its end opposite the upstanding leg 40.

The feed device is secured to a bracket 48 mounted, through the medium of the spring plates 50 and 52, on a stand 54 secured to the base plate portion 56 of the housing 12. The stand 54 carries a vibratory device 58 which, when energized, imparts generally horizontal reciprocation to the feed device 42. As is well known for this type of material feed device, there is also a slight upward component of movement so that the particulate material is thrown upwardly as well as horizontally to produce a generally horizontal feed whose rate is dependent upon the frequency and amplitude of the reciprocating motion imparted by the device 58.

The dispensing head 60 is fixed to the base plate 56 and includes an inlet spout 62 coupled to the depending leg 46 of the feed device 42 by means of a flexible sleeve 64. The inlet spout 62 leads to the cavity 66 provided in the main body portion 68 of the dispensing head and, as may be seen in FIG. 3, the two discharge nozzles 16 and 18 communicate with this cavity below the valve or valve plate 70.

The valve plate 70 is carried by the shaft 72 of a rotary solenoid 74 which normally biases the valve plate 70 to the full line position shown in FIG. 3 and, when energized, urges the valve plate 70 to the dashed line position. Thus, as the solenoid shaft 72 is actuated, the valve sweeps back and forth across the inlet opening alternately directing the material flow either to the discharge nozzle 18 or to the discharge nozzle 16. As will appear hereinafter, the extracted sample is dispensed through the nozzle 16.

In operation, a representative batch of particulate material is placed in the funnel 34, the controls adjusted, and the apparatus energized. The vibratory feeder feeds the material to the dispensing head at a predetermined rate and the valve 70 is actuated between its two positions to dispense a greater or lesser proportion of the feed to the discharge nozzle 16. The rotary solenoid is driven in such fashion as to control the residence times of the valve plate 70 in its two positions. Thus, at one end of the scale, the valve is symmetrically actuated so that 50 percent of the material is directed to each discharge nozzle whereas at the other extreme, 1 percent of the material is directed to the nozzle 16 while the remaining 99 percent is directed to the discharge nozzle 18. The two portions dispensed are thus aliquot portions of the material feed.

As the proportion of material fed to the nozzle 16 decreases, the feed rate is controlled likewise to decrease so that the total feed time is increased, thus allowing the rotary solenoid 74 to execute a greater number of cycles during the feed time. In this way, the sum of the residence times of the valve 70 in its dashed line position (FIG. 3) will represent an absolute time value of reasonable duration. For example, at a 50-50 operation of the valve 70, a total feed time of 10 seconds is representative, effecting total residence times of 5 seconds for the valve in each position whereas at a 1-99 valve operation the feed time is increased to 50.5 seconds, the valve 70 then having a residence time sum of 0.5 seconds in its dashed line position and a residence time sum of 50 seconds in its full line position. Intermediate separations are accomplished with intermediate length feed times. From this, it will be apparent that the minimum batch size is more or less fixed as is required in order to assure that the batch is representative of the parent material from which it is obtained.

FIG. 4 illustrates a circuit arrangement for effecting the above described operation. Power is obtained by means of a suitable plug 76 for connection to ordinary line voltage and it will be seen that the winding 78 of the vibratory feeder 58 is energized directly from the line voltage under the control of the potentiometer 80. The movable top 82 of this potentiometer is controlled by the knob 28 (FIG. 1) so that the feeder 58 operates at line voltage frequency and at an amplitude which is adjusted by the potentiometer 80.

The line voltage is fed through a suitable step down transformer 84 to a conventional rectifier bridge 86 whose output is smoothed in conventional manner and then applied across the voltage control Zener diode 88, as shown. The next stage of the circuit consists of a relaxation oscillator which comprises an RC circuit in parallel with the relaxation device. The resistor 90 is in series with the variable resistor 92 whose movable tap 94 and that of the resistor 96 are controlled simultaneously by the control knob 26 (FIG. 1), and the charging capacitor 98 is in series with the resistor chain 90, 92. In parallel with this RC circuit is the resistor 100, the double-base diode 102 and the resistor 104. The charging time for the capacitor 98 is varied by the resistor 92 and the maximum charging potential is reached when the firing potential of the double-base diode 102 is reached, whereafter the capacitor discharges through the diode 102 and the resistor 104, producing a sawtooth potential at the junction 106.

The junction 106 is connected to the base of the transistor 108 comprising one of the transistor pair 108, 110 connected across the DC voltage supply through the previously mentioned variable resistor 96. Since the transistor 108, 110 will begin to conduct at some potential less than the maximum charging potential of the capacitor 98, voltage pulses of increasing amplitude appear at the movable tap 112 of the variable resistor whose duration and frequency are dependent upon the frequency at which the relaxation oscillator is operating. As soon as each voltage pulse reaches the cutoff level for the transistor 114, a negative-going pulse appears at the base of the transistor 116 through the resistor chain 118, 120, 122 so that a negative-going pulse, appearing at the junction 124 due to the voltage drop across the resistor 126 in the collector-emitter path of the transistor 116, will turn the power transistor 128 on so as to energize the winding 130 of the rotary solenoid 74.

The present invention, therefore, is well adapted to carry out the objects and attain the ends and advantages mentioned

as well as others inherent therein. While the presently illustrative embodiments of the invention are given for the purpose of disclosure, numerous changes in the details of construction and arrangement of parts may be made which will readily suggest themselves to those skilled in the art and which are encompassed within the spirit of the invention and the scope of the appended claims.

We claim:

1. A device for extracting a small representative quantity of particulate material from a batch thereof taken from a much larger supply and which is sufficiently large as to be representative of such supply, said device comprising, in combination, a reservoir for containing said batch of particulate material, a dispensing head having a pair of discharge openings one of which is adapted to discharge said small representative quantity of particulate material,

conveyor means for feeding said batch of material to said dispensing head,

valve means for dispensing head including mechanism for cyclically operating said valve means between first and second positions, the first position uncovering said one discharge opening and the second position uncovering the other discharge opening, and the residence times of said valve means in its two positions constituting the cycle period,

first control means for varying the ratio of said residence times of said valve means,

and second control means for varying the feed time of said conveyor means to accommodate for variation of residence times ratio effected by said first control means.

2. The device according to claim 1, wherein said mechanism comprises an oscillatory solenoid and said first control means includes a relaxation oscillator so arranged as to drive the solenoid alternatively to said two positions with controlled residence at each position.

3. The device according to claim 2, wherein said conveyor means is a vibratory feeder.

4. The device according to claim 3, wherein said second control means controls the amplitude of vibration of said vibratory feeder. vibratory

5. The device according to claim 4, wherein said reservoir is a hopper, said vibratory feeder having an elongated tubular body, and flexible couplings between said hopper and said tubular body and between said tubular body and said dispensing head.

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